

Circular Motion Test (CMT) Program for KCS in deep water at NMRI

Hull, Propeller and Rudder Geometry: In agreement with the definitions

(stimulator: Studs at S.S. 9 1/2 and bulb, 2.5 mm height and 10.0 mm pitch)

Model Length: 3.0464 m (Lpp) (Scale Ratio: 1 / 75.50=3.0464/230.0)

Towing Speed: 1.100(m/s) (18.58kt for the full-scale ship)

Propeller Revolution: 12.93(rps) (model-scale propulsion point at towing speed, 1.1m/s)

GM(m): 0.097 (m) (7.326m for the actual ship)

Center of captive motion: Horizontal: midship of center line of model, Vertical: 71.0 mm above BL

Heave, Pitch, Roll: Free

Water Depth: 1.20 m (Draft/Depth Ratio: 1 / 8.39)

Data Correction:

Effects of mass in the measuring system (0.434kg for surge direction and 0.764kg for sway direction) affecting on the measured forces are subtracted corresponding to the centrifugal acceleration.

Measured Item:

Towing speed, Oblique angle, Yaw rate,
Surge force, Sway force, Yaw moment (measured at midship),
Rudder angle, Rudder normal force,
Propeller revolution, Propeller thrust

Test Conditions:

(1) Resistance & Self Propulsion Test

HPR condition	Towing Speed: U (m/s)	Prop. Revolution: n (rps)	Yaw Rate: $r' = r(L/U)$ (non-dim.)	Drift Angle: β (degree)	Rudder Angle: δ (degree)
HR	0.700	N/A	0.0	0	0
	0.800				
	0.900				
	1.000				
	1.100				
	1.200				
HPR	0.700	8.96	0.0	0	0
	0.800	9.80			
	0.900	10.83			
	1.000	11.98			
	1.100	13.15			
	1.200	14.28			

(2) Rudder Angle Test

HPR condition	Towing Speed: U (m/s)	Prop. Revolution: n (rps)	Yaw Rate: $r' = r(L/U)$ (non-dim.)	Drift Angle: β (degree)	Rudder Angle: δ (degree)
HR	1.100	N/A	0.0	0	-25, -20, -15, -10, -5, 0, 5, 10, 15, 20, 25
HPR	1.100	10.33	0.0	0	-20, -15, -10, -5, 0, 5, 10, 15, 20
		12.93 (model point)			-35, -30, -25, -20, -15, -10, -5, 0, 5, 10, 15, 20, 25, 30
		18.10			-15, -10, -5, 0, 5, 10, 15

(3) Circular Motion Test

HPR condition	Towing Speed: U (m/s)	Prop. Revolution: n (rps)	Yaw Rate: $r' = r(L/U)$ (non-dim.)	Drift Angle: β (degree)	Rudder Angle: δ (degree)
HR	1.100	N/A	0.0	6	-10, 0, 10, 20
				12	-16, -8, 0, 8, 16, 24
			0.4	0	0, 8, 16
HPR	1.100	12.93	-0.6	0	0, 12
				-12, 8	0
			-0.4	0	-30, -20, -10, -9, 0, 9, 18
				-12, 12	0
			-0.3	0	-8, 0
			-0.2	0	-4, 0
				-12, 12	0
			-0.1	0	-4, 0
			0	-20	-10, 0
				-16	-25, -15, -8, 0, 8, 15, 25
				-12	-8, 0
				-8	-20, -10, -5, 0, 10, 20
				-4	-4, 0
				-6, -2, 0, 2, 6	0
				4	0, 4
8	-20, -15, -10, 0, 5, 10, 20				
12	0, 8				
16	-25, -20, -15, -8, 0, 5, 10, 15, 25				
20	0, 10				
0.1	0	0, 4			
0.2	0	0, 4			

			0.2	-12, 0, 2, 4, 6, 8, 12, 16,	0
			0.3	0	0, 6
			0.4	0	-20, -10, 0, 8, 15, 25
				-12, 2, 4, 6, 8, 12, 16	0
			0.6	0	0, 12
				-12, 2, 4, 6, 8, 12, 16	0

(4) Measurement for Uncertainty Analysis

HPR condition	Towing Speed: U (m/s)	Prop. Revolution: n (rps)	Yaw Rate: $r' = r(L/U)$ (non-dim.)	Drift Angle: β (degree)	Rudder Angle: δ (degree)	Number of Runs
HPR	1.100	12.93	0.4	0	0	10
			0.0	12	0	10

PMM Test Program for KCS in deep water at NMRI

Hull, Propeller and Rudder Geometry: In agreement with the definitions

(stimulator: Studs at S.S. 9 1/2 and bulb, 2.5 mm height and 10.0 mm pitch)

Model Length: 3.0464 m (Lpp) (Scale Ratio: 1 / 75.50=3.0464/230.0)

Towing Speed: 1.100(m/s) (18.58kt for the actual ship)

Propeller Revolution: 12.93(rps) (model-scale propulsion point at towing speed, 1.1m/s)

GM(m): 0.097 (m) (7.326m for the actual ship)

Center of captive motion: Horizontal: midship of center line of model, Vertical: 71.0 mm above BL

Heave, Pitch, Roll: Free

Water Depth: 1.20 m (Draft/Depth Ratio: 1 / 8.39)

Data Correction:

Effects of mass in the measuring system (0.434kg for surge direction and 0.764kg for sway direction) affecting on the measured forces are subtracted corresponding to the centrifugal acceleration.

Measured Item:

Towing speed, Oblique angle, Yaw rate,
Surge force, Sway force, Yaw moment (measured at midship),
Rudder angle, Rudder normal force,
Propeller revolution, Propeller thrust

Test Conditions:

HPR condition	Towing Speed: U (m/s)	Prop. Revolution: n (rps)	Mode	Period: T (sec)	Oblique Angle Amplitude: β_a (degree)	Yaw Rate Amplitude: $r_a' = r_a(L/U)$ (non-dim.)	Rudder Angle: δ (degree)
HPR	1.100	12.93	Pure Sway	9.0	8	0.0	0
				6.0	8	0.0	0
			Pure Yaw	9.0	0	0.3	0
				6.0	0	0.3	0
			Combined	9.0	6	0.2025	0
				6.0	4	0.2025	0
HR	1.100	12.93	Pure Sway	9.0	8	0.0	0
				6.0	8	0.0	0
			Pure Yaw	9.0	0	0.3	0
				6.0	0	0.3	0
			Combined	9.0	6	0.2025	0
				6.0	4	0.2025	0